

C4AE Series, Radial, 2 or 4 Leads, 450 – 1,100 VDC, for DC Link

Overview

The C4AE Series is a polypropylene metallized film with rectangular plastic box type filled with resin and 2 or 4 tinned copper wires.

Applications

Typical applications include DC filtering and energy storage.

Benefits

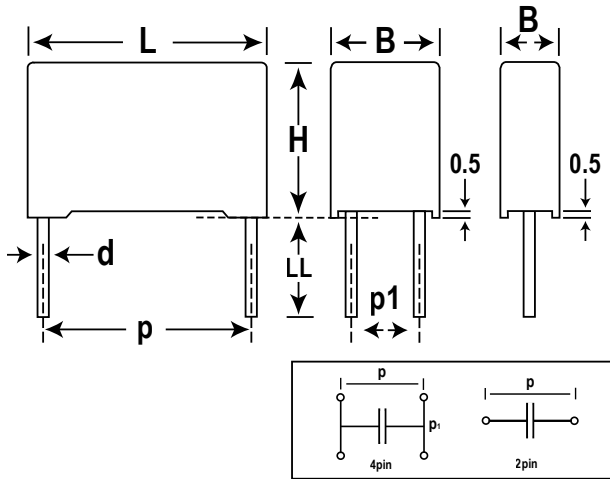
- Self-healing
- Low losses
- High ripple current
- High capacitance density
- High contact reliability
- Suitable for high frequency applications



Part Number System

| C4 | AE | G | B | U | 4450 | A1 | W | J |
|---------------------|--------------------------------------|---|--|--------------------------|---|----------------------|---------------------|-----------|
| Series | Type | Rated Voltage (VDC) | Case | Number of Leads | Capacitance Code (pF) | Lead Diameter (mm) | Size Code | Tolerance |
| C4 = MKP capacitors | AE = Radial box, dc-link application | G = 450 H = 600 J = 700 O = 900 Q = 1,100 | B = Plastic box with epoxy resin sealing | U = 2 lead W = 4 lead | Digits 2 – 4 indicate the first three digits of the capacitance value. First digit indicates the number of zeros to be added. | A1 = 0.8 A3 = 1.2 | See Dimension Table | J = 5% |

Dimensions – Millimeters



| Size Code | p | p1 | B | H | L | LL |
|-----------|------|------|---------|---------|---------|-------|
| | ±0.4 | ±0.4 | Maximum | Maximum | Maximum | +0/-2 |
| W | 27.5 | | 11 | 20 | 31.5 | 6 |
| X | 27.5 | | 13 | 25 | 31.5 | 6 |
| Y | 27.5 | | 14 | 28 | 31.5 | 6 |
| 1 | 27.5 | | 19 | 29 | 31.5 | 6 |
| 2 | 27.5 | | 22 | 37 | 31.5 | 6 |
| F | 37.5 | 10.2 | 20 | 40 | 41.5 | 6 |
| H | 37.5 | 10.2 | 24 | 44 | 41.5 | 6 |
| J | 37.5 | 10.2 | 28 | 37 | 42.5 | 6 |
| L | 37.5 | 20.3 | 30 | 45 | 42 | 6 |
| M | 52.5 | 20.3 | 30 | 45 | 57.5 | 6 |
| N | 52.5 | 20.3 | 35 | 50 | 57.5 | 6 |

Qualification

| | |
|---------------------|-----------------------------------|
| Reference Standards | IEC 61071 |
| Climatic Category | 40/85/56 according to IEC 60068-1 |

General Technical Data

| | |
|-------------------------------|---|
| Dielectric | Polypropylene metallized film - non inductive self-healing |
| Application | DC filtering / DC-Link |
| Maximum Operating Temperature | +105°C |
| Upper Temperature T_{MAX} | +85°C IEC 61071, Endurance Test Temperature |
| Lower Temperature T_{MIN} | -40°C |
| Protection | "Solvent resistant plastic case UL94 V-0 Thermosetting resin sealing UL94 V-0 compliant" |
| Installation | Any position |
| Leads | Tinned copper wires |
| Packaging | Packed in cardboard trays with protection for the terminals |
| RoHS Compliant | Compliant with the restricted substance requirements of Directive 2002/95/EC |

Electrical Characteristics

| | |
|------------------------------------|--|
| Capacitance tolerance | $\pm 5\%$ at +25°C |
| Dissipation factor (DF) | ≤ 0.0002 at 10 kHz and +25°C ($\pm 5^\circ\text{C}$) |
| Surge voltage | $1.5 * V_{NDC}$ for maximum 10 times in life time at 25°C |
| Overvoltage (IEC 61071) | $1.15 * V_{NDC}$ for maximum 30 minutes - once per day |
| | $1.3 * V_{NDC}$ for maximum 1 minute - once per day |
| Peak non Repetitive current | $1.5 * I_{PKR}$ - maximum 1000 times in life time |
| Insulation Resistance | $IR \times C \geq 30.000$ seconds at 100 VDC 1 minute (+25°C) |
| Capacitance deviation in operation | $\pm 1.5\%$ maximum on capacitance value measured at (+25°C) |
| Permissible relative humidity | Annual average $\leq 70\%$; 85% on 30 days/year randomly distributed throughout the year. Dewing not admissible |

Life Expectancy

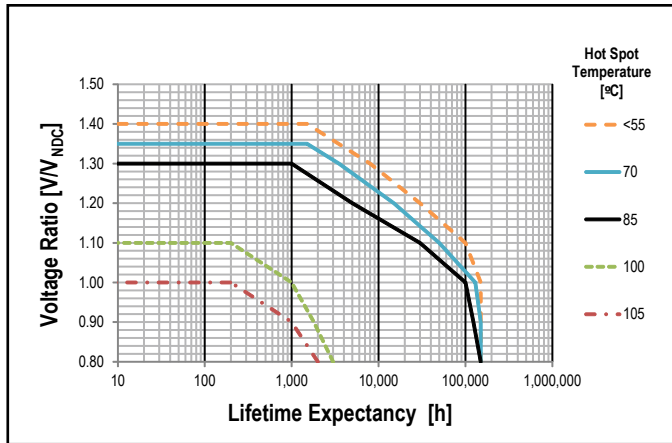
| | |
|---------------------------------|--|
| Life expectancy | 100.000 hours at V_{NDC} @ Hot-Spot temperature $T_{HS} = +85^\circ\text{C}$ |
| Capacitance drop at end of life | -5% (typical) |
| Failure rate IEC 61709 | 300 FIT at V_{NDC} @ Hot-Spot temperature $T_{HS} = +85^\circ\text{C}$ |

Test Method

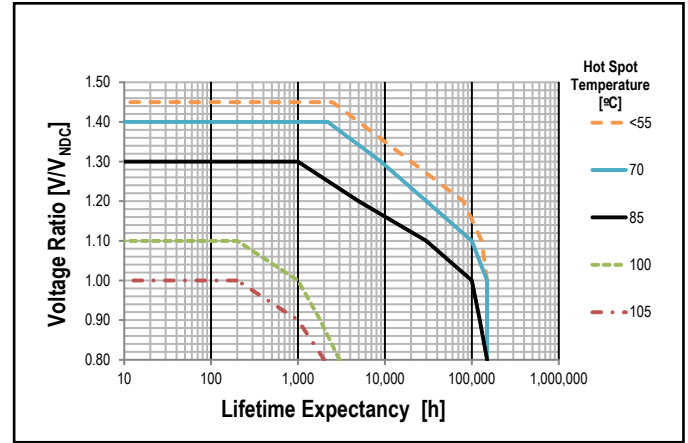
| | |
|---|--|
| Test voltage between terminals | $1.5 * V_{NDC}$ for 10 seconds or $1.65 V_{NDC}$ for 2 seconds, at +25°C |
| Test voltage between terminals and case | 3.2 kVac 50 Hz for 2 seconds |
| Damp Heat | IEC 60068-2-78 |
| Change of temperature | IEC 60068-2-14 |

Lifetime Expectancy/Failure Quota Graphs

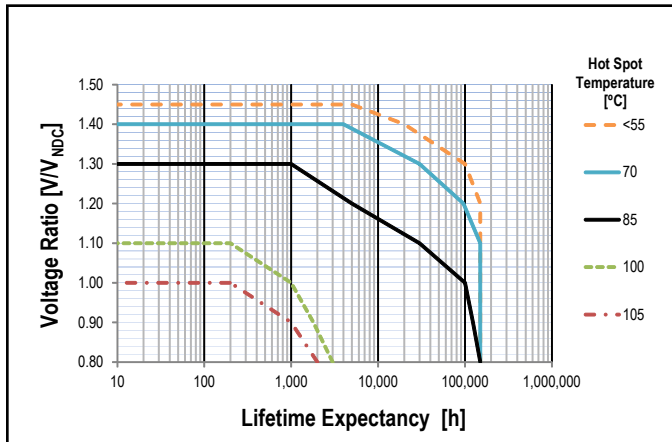
Lifetime Curve $V_{NDC} = 450$ V-



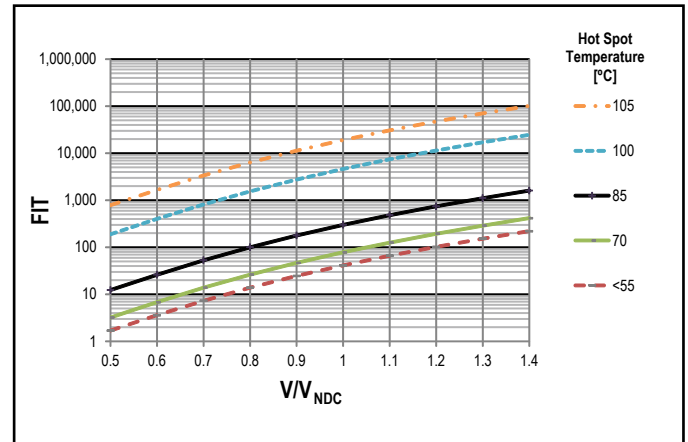
Lifetime Curve $V_{NDC} = 600$ V- and $V_{NDC} = 700$ V-



Lifetime Curve $V_{NDC} = 900$ V- and $V_{NDC} = 1,100$ V-



FIT @ Hot Spot Temperatures



Notes:

$$T_{HS} = T_{AMB} + \Delta T$$

$$\Delta T = ESR * I_{rms}^2 * R_{th}$$

I_{rms} should be limited to values granting $\Delta T \leq 30^{\circ}\text{C}$

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and the production of them.

In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, like Lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products to fulfill these legislative requirements. The only material of concern in our products has been Lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of Lead in any homogeneous material.

KEMET will closely follow any changes in legislation world wide and makes any necessary changes in its products, whenever needed. Some customer segments like Medical, Military and Automotive Electronics may still require the use of Lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

Because of customer requirements there may appear additional markings like LF = Lead Free or LFW = Lead Free Wires on the label.

Materials & Environment

The selection of materials used by KEMET for the production of capacitors is the result of extensive experience and constant attention to environmental protection. KEMET selects its suppliers according to ISO 9001 standards and carries out statistical analysis on the materials purchased before acceptance. All materials are, to the company's present knowledge, non-toxic and free from Cadmium, Mercury, Chrome and compounds, PCB (Polychlorine Triphenyl), Bromide and Chlorine Dioxins Bromurate Chlorurate, CFC and HCFC and Asbestos.

Green Products

All KEMET power film products are ROHS Compliant.

Insulation Resistance

When the capacitor temperature increases, the insulation resistance decreases. This is due to increased electron activity. Low insulation resistance can also be the result of moisture trapped in the windings, caused by a prolonged exposure to excessive humidity.

Dissipation Factor

Dissipation factor is a complex function involved with the inefficiency of the capacitor. The $\tan\delta$ may change up and down with increased temperature. For more information, please refer to Performance Characteristics.

Sealing

Hermetically Sealed Capacitors

When the temperature increases, the pressure inside the capacitor increases. If the internal pressure is high enough, it can cause a breach in the capacitor which can result in leakage, impregnation, filling fluid or moisture susceptibility.

Resin Encased/Wrap & Fill Capacitors

The resin seals on resin encased and wrap and fill capacitors will withstand short-term exposure to high humidity environments without degradation. Resins and plastic tapes will form a pseudo-impervious barrier to humidity and chemicals. These case materials are somewhat porous and through osmosis can cause contaminants to enter the capacitor. The second area of contaminated absorption is the lead-wire/resin interface. Since resins cannot bond 100% to tinned wires, there can be a path formed up to the lead wire into the capacitor section. Aqueous cleaning of circuit boards can aggravate this condition.

Barometric Pressure

The altitude at which hermetically sealed capacitors are operated controls the voltage rating of the capacitor. As the barometric pressure decreases, the susceptibility to terminal arc-over increases. Non-hermetic capacitors can be affected by internal stresses due to pressure changes. This can be in the form of capacitance changes or dielectric arc-over as well as low insulation resistance. Heat transfer can also be affected by altitude operation. Heat generated in operation cannot be dissipated properly and can result in high R12 losses and eventual failure.

Radiation

Radiation capabilities of capacitors must be taken into consideration. Electrical degradation in the form of dielectric embitterment can take place causing shorts or opens.

Table 1 – Ratings & Part Number Reference

| Cap Value (µF) | VDC | Dimensions (mm) | | | | | dV/dt (V/µs) | lpkr | ESL | ESR | | Irms* | | Rth | PART NUMBER |
|----------------|------|-----------------|----|------|------|------|--------------|------|-----|-------------|------|-------------|-----------------|----------|-------------|
| | | B | H | L | P | P1 | | | | 70°C@10 kHz | | 70°C@10 kHz | | (HS/Amb) | |
| | | | | | | | | | | Apk | nH | mΩ | Arms | (°C/W) | |
| 4.5 | 450 | 11 | 20 | 31.5 | 27.5 | \ | 14 | 65 | 25 | 14.2 | 4.5 | 44 | C4AEGBU4450A1WJ | | |
| 6.8 | 450 | 13 | 25 | 31.5 | 27.5 | \ | 15 | 101 | 25 | 10.0 | 6.0 | 36 | C4AEGBU4680A1XJ | | |
| 10 | 450 | 14 | 28 | 31.5 | 27.5 | \ | 14 | 145 | 26 | 7.4 | 7.5 | 33 | C4AEGBU5100A1YJ | | |
| 12.5 | 450 | 19 | 29 | 31.5 | 27.5 | \ | 15 | 187 | 26 | 6.2 | 8.5 | 29 | C4AEGBU5125A11J | | |
| 20 | 450 | 22 | 37 | 31.5 | 27.5 | \ | 15 | 303 | 28 | 4.8 | 11.0 | 23 | C4AEGBU5200A12J | | |
| 30 | 450 | 20 | 40 | 41.5 | 37.5 | 10.2 | 10 | 298 | 30 | 4.1 | 13.0 | 20 | C4AEGBW5300A3FJ | | |
| 35 | 450 | 28 | 37 | 42.5 | 37.5 | 10.2 | 10 | 355 | 30 | 3.5 | 14.0 | 18 | C4AEGBW5350A3JJ | | |
| 40 | 450 | 24 | 44 | 41.5 | 37.5 | 10.2 | 10 | 406 | 30 | 3.1 | 16.0 | 17 | C4AEGBW5400A3HJ | | |
| 50 | 450 | 30 | 45 | 42 | 37.5 | 20.3 | 10 | 508 | 30 | 2.5 | 18.0 | 15 | C4AEGBW5500A3LJ | | |
| 75 | 450 | 30 | 45 | 57.5 | 52.5 | 20.3 | 7 | 503 | 35 | 3.4 | 18.0 | 12 | C4AEGBW5750A3MJ | | |
| 100 | 450 | 35 | 50 | 57.5 | 52.5 | 20.3 | 7 | 677 | 35 | 2.6 | 22.0 | 10 | C4AEGBW6100A3NJ | | |
| 3.3 | 600 | 11 | 20 | 31.5 | 27.5 | \ | 17 | 55 | 25 | 17.0 | 4.0 | 44 | C4AEHBU4330A1WJ | | |
| 5.6 | 600 | 13 | 25 | 31.5 | 27.5 | \ | 17 | 94 | 25 | 10.7 | 6.0 | 36 | C4AEHBU4560A1XJ | | |
| 7 | 600 | 14 | 28 | 31.5 | 27.5 | \ | 17 | 118 | 26 | 9.0 | 7.0 | 33 | C4AEHBU4700A1YJ | | |
| 10 | 600 | 19 | 29 | 31.5 | 27.5 | \ | 17 | 169 | 26 | 6.8 | 8.5 | 29 | C4AEHBU5100A11J | | |
| 15 | 600 | 22 | 37 | 31.5 | 27.5 | \ | 17 | 253 | 28 | 5.3 | 10.5 | 23 | C4AEHBU5150A12J | | |
| 20 | 600 | 20 | 40 | 41.5 | 37.5 | 10.2 | 11 | 229 | 30 | 5.3 | 11.0 | 20 | C4AEHBW5200A3FJ | | |
| 30 | 600 | 28 | 37 | 42.5 | 37.5 | 10.2 | 11 | 337 | 30 | 3.6 | 14.0 | 18 | C4AEHBW5300A3JJ | | |
| 40 | 600 | 30 | 45 | 42 | 37.5 | 20.3 | 11 | 458 | 30 | 2.8 | 18.0 | 15 | C4AEHBW5400A3LJ | | |
| 55 | 600 | 30 | 45 | 57.5 | 52.5 | 20.3 | 8 | 425 | 35 | 4.1 | 16.5 | 12 | C4AEHBW5550A3MJ | | |
| 75 | 600 | 35 | 50 | 57.5 | 52.5 | 20.3 | 8 | 579 | 35 | 3.1 | 20.5 | 10 | C4AEHBW5750A3NJ | | |
| 2.7 | 700 | 11 | 20 | 31.5 | 27.5 | \ | 19 | 51 | 25 | 18.3 | 4.0 | 44 | C4AEJBU4270A1WJ | | |
| 4 | 700 | 13 | 25 | 31.5 | 27.5 | \ | 19 | 77 | 25 | 12.9 | 5.5 | 36 | C4AEJBU4400A1XJ | | |
| 5 | 700 | 14 | 28 | 31.5 | 27.5 | \ | 19 | 96 | 26 | 10.7 | 6.0 | 33 | C4AEJBU4500A1YJ | | |
| 8 | 700 | 19 | 29 | 31.5 | 27.5 | \ | 19 | 154 | 26 | 7.3 | 8.0 | 29 | C4AEJBU4800A11J | | |
| 12.5 | 700 | 22 | 37 | 31.5 | 27.5 | \ | 19 | 241 | 28 | 5.5 | 10.0 | 23 | C4AEJBU5125A12J | | |
| 15 | 700 | 20 | 40 | 41.5 | 37.5 | 5.1 | 13 | 196 | 30 | 6.2 | 10.0 | 20 | C4AEJBW5150A3FJ | | |
| 20 | 700 | 28 | 37 | 42.5 | 37.5 | 10.2 | 13 | 262 | 30 | 4.7 | 12.5 | 18 | C4AEJBW5200A3JJ | | |
| 22 | 700 | 24 | 44 | 41.5 | 37.5 | 10.2 | 13 | 288 | 30 | 4.3 | 13.0 | 17 | C4AEJBW5220A3HJ | | |
| 30 | 700 | 30 | 45 | 42 | 37.5 | 20.3 | 13 | 389 | 30 | 3.2 | 16.5 | 15 | C4AEJBW5300A3LJ | | |
| 45 | 700 | 30 | 45 | 57.5 | 52.5 | 20.3 | 9 | 389 | 35 | 4.4 | 16.0 | 12 | C4AEJBW5450A3MJ | | |
| 55 | 700 | 35 | 50 | 57.5 | 52.5 | 20.3 | 9 | 485 | 35 | 3.6 | 19.0 | 10 | C4AEJBW5550A3NJ | | |
| 60 | 700 | 35 | 50 | 57.5 | 52.5 | 20.3 | 9 | 530 | 35 | 3.4 | 19.5 | 10 | C4AEJBW5600A3NJ | | |
| 1.5 | 900 | 11 | 20 | 31.5 | 27.5 | \ | 24 | 36 | 25 | 26.3 | 3.5 | 44 | C4AEQBU4150A1WJ | | |
| 2.7 | 900 | 13 | 25 | 31.5 | 27.5 | \ | 24 | 65 | 25 | 15.3 | 5.0 | 36 | C4AEQBU4270A1XJ | | |
| 3.3 | 900 | 14 | 28 | 31.5 | 27.5 | \ | 24 | 79 | 26 | 12.9 | 5.5 | 33 | C4AEQBU4330A1YJ | | |
| 5 | 900 | 19 | 29 | 31.5 | 27.5 | \ | 24 | 120 | 26 | 9.1 | 7.0 | 29 | C4AEQBU4500A11J | | |
| 8 | 900 | 22 | 37 | 31.5 | 27.5 | \ | 24 | 193 | 28 | 6.6 | 9.5 | 23 | C4AEQBU4800A12J | | |
| 12 | 900 | 20 | 40 | 41.5 | 37.5 | 10.2 | 16 | 190 | 30 | 6.3 | 10.0 | 20 | C4AEQBW5120A3FJ | | |
| 14 | 900 | 28 | 37 | 42.5 | 37.5 | 10.2 | 16 | 229 | 30 | 5.4 | 11.5 | 18 | C4AEQBW5140A3JJ | | |
| 16 | 900 | 24 | 44 | 41.5 | 37.5 | 10.2 | 16 | 256 | 30 | 4.8 | 13.0 | 17 | C4AEQBW5160A3HJ | | |
| 20 | 900 | 30 | 45 | 42 | 37.5 | 20.3 | 16 | 321 | 30 | 3.9 | 15.0 | 15 | C4AEQBW5200A3LJ | | |
| 30 | 900 | 30 | 45 | 57.5 | 52.5 | 20.3 | 11 | 324 | 35 | 5.2 | 15.0 | 12 | C4AEQBW5300A3MJ | | |
| 40 | 900 | 35 | 50 | 57.5 | 52.5 | 20.3 | 11 | 428 | 35 | 4.0 | 18.0 | 10 | C4AEQBW5400A3NJ | | |
| 1 | 1100 | 11 | 20 | 31.5 | 27.5 | \ | 28 | 28 | 25 | 33.1 | 3.0 | 44 | C4AEQBU4100A1WJ | | |
| 1.8 | 1100 | 13 | 25 | 31.5 | 27.5 | \ | 29 | 52 | 25 | 19.1 | 4.5 | 36 | C4AEQBU4180A1XJ | | |
| 2.2 | 1100 | 14 | 28 | 31.5 | 27.5 | \ | 29 | 63 | 26 | 16.0 | 5.0 | 33 | C4AEQBU4220A1YJ | | |
| 3.3 | 1100 | 19 | 29 | 31.5 | 27.5 | \ | 29 | 95 | 26 | 11.2 | 6.5 | 29 | C4AEQBU4330A11J | | |
| 5 | 1100 | 22 | 37 | 31.5 | 27.5 | \ | 29 | 145 | 28 | 8.2 | 8.5 | 23 | C4AEQBU4500A12J | | |
| 8 | 1100 | 20 | 40 | 41.5 | 37.5 | 10.2 | 20 | 157 | 30 | 7.9 | 9.0 | 20 | C4AEQBW4800A3FJ | | |
| 10 | 1100 | 28 | 37 | 42.5 | 37.5 | 10.2 | 20 | 196 | 30 | 6.3 | 11.0 | 18 | C4AEQBW5100A3JJ | | |
| 12 | 1100 | 30 | 45 | 42 | 37.5 | 20.3 | 20 | 235 | 30 | 5.3 | 13.0 | 15 | C4AEQBW5120A3LJ | | |
| 20 | 1100 | 30 | 45 | 57.5 | 52.5 | 20.3 | 13 | 262 | 35 | 6.5 | 13.0 | 12 | C4AEQBW5200A3MJ | | |
| 25 | 1100 | 35 | 50 | 57.5 | 52.5 | 20.3 | 13 | 331 | 35 | 5.2 | 16.0 | 10 | C4AEQBW5250A3NJ | | |
| 27 | 1100 | 35 | 50 | 57.5 | 52.5 | 20.3 | 13 | 354 | 35 | 4.9 | 16.5 | 10 | C4AEQBW5270A3NJ | | |
| Cap Value (µF) | VDC | B | H | L | P | P1 | dV/dt (V/µs) | lpkr | ESL | ESR | Irms | Rth | Part Number | | |

(1) Current values that lead to a ΔT of ~ 15°C in the hot spot → T_{HS} = T_{AMB} + ΔT = 70°C + 15°C = 85°C

For Packaging quantities not listed contact KEMET

KEMET Corporation World Headquarters

2835 KEMET Way
Simpsonville, SC 29681

Mailing Address:
P.O. Box 5928
Greenville, SC 29606

www.kemet.com
Tel: 864-963-6300
Fax: 864-963-6521

Corporate Offices
Fort Lauderdale, FL
Tel: 954-766-2800

North America

Northeast
Wilmington, MA
Tel: 978-658-1663

Southeast
Lake Mary, FL
Tel: 407-855-8886

Central
Novi, MI
Tel: 248-994-1030

Irving, TX
Tel: 972-915-6041

West
Milpitas, CA
Tel: 408-433-9950

Mexico
Guadalajara, Jalisco
Tel: 52-33-3123-2141

Europe

Southern Europe
Sasso Marconi, Italy
Tel: 39-051-939111

Skopje, Macedonia
Tel: 389-2-55-14-623

Central Europe
Landsberg, Germany
Tel: 49-8191-3350800

Kamen, Germany
Tel: 49-2307-438110

Northern Europe
Wyboston, United Kingdom
Tel: 44-1480-273082

Espoo, Finland
Tel: 358-9-5406-5000

Asia

Northeast Asia
Hong Kong
Tel: 852-2305-1168

Shenzhen, China
Tel: 86-755-2518-1306

Beijing, China
Tel: 86-10-5877-1075

Shanghai, China
Tel: 86-21-6447-0707

Seoul, South Korea
Tel: 82-2-6294-0550

Taipei, Taiwan
Tel: 886-2-27528585

Southeast Asia
Singapore
Tel: 65-6701-8033

Penang, Malaysia
Tel: 60-4-6430200

Bangalore, India
Tel: 91-806-53-76817

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